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User's Manual for the Modular Analysis-Package Libraries ANAPAC and TRANL

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This report is a supplement to the user's manual for the ANAPAC and TRANL libraries (HDL-TR-1782) and reflects the conversion of these libraries from a CDC computer to the HDL IBM 370/168 computer. Only presented are those modifications which affect the usage of previously presented software routines and new software routines added since the publication of the original user's manual. The usage of those software routines on the HDL IBM computer not discussed in this report is unaffected.

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1. INTRODUCTION

The ANAPAC and TRANL[1] modular analysis-package libraries are a collection of independent computer software programs and subroutines, each written to do a specific task. This report is a supplement to the user's manual for the ANAPAC and TRANL libraries and reflects the conversion of these user libraries from the Mobility Equipment Research and Development Command (MERADCOM) CDC 6600 computer to the Harry Diamond Laboratories (HDL) IBM 370/168 computer. Some modifications to the existing subroutines and the addition of new subroutines were required to preserve the capabilities of the ANAPAC library during the conversion effort. A user's guide for those subroutines whose usage was affected by the modification and for the new subroutines added to the ANAPAC library are presented (sect. 2 and 3) along with a JCL (job control language) catalogued procedure named ANAFORT (sect. 4) for including the ANAPAC library in the execution of a FORTRAN program. The TRANL library could not be conveniently preserved as a user's library, but the programs stored in the library are accessed through catalogued procedures with the same names (sect. 5).

2. DESCRIPTION OF MODIFIED PROGRAMS FROM THE ANAPAC LIBRARY

The following software was modified to accommodate the difference in word length between the IBM computer and the CDC computer.

2.1 Subroutine DRAW1

The FORTRAN subprogram DRAW1 is called as follows:

```
CALL DRAW1(ITYPE,IXLAB,IYLAB,IPTLAB,ISBLAB,NPT,
           ZAX,ZAY,XLAB,YLAB,PTLAB,SUBLAB,X,Y)
```

The first six formal parameters in the subroutine argument list are integer variables; the remaining eight are real variables. The definition and use of each is as follows.

ITYPE Variable used to select the type of plot.

If ITYPE=1 a linear-linear plot is selected.

=2 a log-log plot is selected.

[1]*Thomas V. Noon, User's Manual for the Modular Analysis-Package Libraries ANAPAC and TRANL, Harry Diamond Laboratories TR-1782 (November 1976).*

=3 a linear-log plot (semilog with the linear axis for the dependent array) is selected.

=4 a log-linear plot (semilog with the linear axis for the independent array) is selected.

IXLAB Number of words in the label for the independent axis, not to exceed 8. If IXLAB=0, axis label is omitted.

IYLAB Number or words in the label for the dependent axis, not to exceed 8. If IYLAB=0, axis label is omitted.

IPTLAB Number of words in the plot title, not to exceed 20. If IPTLAB=0, plot title is omitted.

ISBLAB Number of words in the plot subtitle, not to exceed 20. If ISBLAB=0, plot subtitle is omitted.

NPT Number of points to be plotted in both the independent and dependent data arrays. If the negative of the number of points is passed through NPT, the data arrays are not restored to the values they had before being passed.

ZAX Variable that determines where the independent axis is drawn.

If ZAX=0. axis is drawn in the standard location. This is also the default position when the next two conditions cannot be met.

=1. axis is drawn at the zero occurrence of the dependent axis.

=2. axis is drawn at a standard location with a zero reference line placed at the zero occurrence on the dependent axis.

ZAY Variable that determines where the dependent axis is drawn.

If ZAY=0. axis is drawn in standard location. This is also the default position when the next conditions cannot be met.

=1. axis is drawn at the zero occurrence of independent axis.

=2. axis is drawn at standard location with the addition of a zero reference line placed at the zero occurrence on the independent axis.

XLAB Array containing user-defined label for the independent axis, not to exceed 8 words (32 characters). If IXLAB=0, a dummy name can be used in the call.

YLAB Array containing user-defined label for the dependent axis, not to exceed 8 words (32 characters). If IYLAB=0, a dummy name can be used in the call.

PTLAB Array containing user-defined title for the plot, not to exceed 20 words (80 characters). If IPTLAB=0, a dummy name can be used in the call.

SUBLAB Array containing user-defined subtitle for the plot, not to exceed 20 words (80 characters). If ISBLAB=0, a dummy name can be used in the call.

X Array containing values of independent variables to be plotted.

Y Array containing values of dependent variables to be plotted.

2.2 Subroutine DRAW4

The FORTRAN subprogram DRAW4 is called as follows.

The first parameter, IP, is used to select the three sections of the DRAW4 subroutine.

For IP=1:

```
CALL DRAW4(IP,IFILE,IXLAB,IYLAB,IPTLAB,ISBLAB,XLAB,YLAB,
           PTLAB, SUBLAB)
```

where

IFILE A number from 1 to 4 or 8 to 13 identifying the scratch file associated with the graph. For each graph the value must be consistent for each value of IP.

IXLAB Number of words in the label for the independent axis, not to exceed a value of 8. If IXLAB=0, axis label is omitted.

IYLAB Number of words in the label for the dependent axis, not to exceed a value of 8. If IYLAB=0, axis label is omitted.

IPTLAB Number of words in the plot title, not to exceed a value of 20. If IPTLAB=0, plot title is omitted.

ISBLAB Number of words in the plot subtitle, not to exceed a value of 20. If ISBLAB=0, plot subtitle is omitted.

XLAB Array containing user-defined label for the independent axis, not to exceed 8 words (32 characters). If IXLAB=0, a dummy name can be used in the call.

YLAB Array containing user-defined label for the dependent axis, not to exceed 8 words (32 characters). If IYLAB=0, a dummy name can be used in the call.

PTLAB Array containing user-defined title for the plot, not to exceed 20 words (80 characters). If IPTLAB=0, a dummy name can be used in the call.

SUBLAB Array containing user-defined subtitle for the plot, not to exceed 20 words (80 characters). If ISBLAB=0, a dummy name can be used in the call.

For IP=2:

```
CALL DRAW4(IP,IFILE,ITYPE,NPTS,KODE,ISPACE,XVAL,
           YVAL,YMIN,YMAX)
```

where

IFILE A number from 1 to 4 or 8 to 13 identifying the scratch file associated with the graph and a previous call to DRAW4 with IP=1.

ITYPE Code used to select the type of plot. Read only on the first call with IP=2 for each IFILE.

If ITYPE=1 a linear plot is selected.

=2 a log-log plot is selected.

=3 a linear-log plot (semilog with the linear axis for the dependent array) is selected.

=4 a log-linear plot (semilog with the linear axis for the independent array) is selected.

NPTS Number of points in both the independent and dependent data arrays to be plotted. For multiple plots, NPTS for each data set does not have to be the same.

KODE The character to be drawn at data points, connected by a line. If KODE is negative, only the symbol is drawn.

If KODE=0 no character

=1 a plus (+)

=2 an X

=3 a triangle (Δ)

=4 a square (□)

=5 an hour glass (⧖)

=6 an up arrow (↑)

=7 a star (*)

Other characters can be drawn by equating KODE to a character (e.g., 4HɃɃɃA, where 'A' is the character to be drawn at data points).

ISPACE (a) ISPACE/10 is the rate of occurrence for the drawing of the symbol designated by the variable KODE. If ISPACE/10>0 and KODE=0, intermediate points are disregarded to give the user a simplified plot.

(b) The last digit of ISPACE determines the type of line to be drawn, provided KODE is not negative.

If the last digit of ISPACE is

0 a solid line is drawn ______

1 a dashed line is drawn - - -

2 a dotted line is drawn . . . .

3 a dash-dot line is drawn -·-·-·

XVAL Array containing values of independent variables to be plotted.

YVAL Array containing values of dependent variables to be plotted.

YMIN Used in the first call with IP=2 to set the minimum value for the dependent axis. If YMIN is zero (0.) it is ignored. For a minimum value of zero, set YMIN equal to a very small number (e.g., 1.E-30). Any values in the arrays that are less than YMIN are set equal to YMIN, thus modifying the arrays.

YMAX Used in the first call with IP=2 to set the maximum value for the depedent axis. If YMAX is zero (0.) it is ignored. Any values in the arrays that are greater than YMAX are set equal to YMAX, thus modifying the arrays.

For IP=3:

CALL DRAW4(IP,IFILE,INCRX,INCRY,ICHOICE,N,X,Y,ZAX,ZAY)

where

IFILE A number from 1 to 4 or 8 to 13 identifying the scratch file associated with the graph and previous calls to DRAW4 with IP=1 and 2.

INCRX Variable used to specify scales for the independent axis other than those calculated by the subprogram. A single-integer number composed of two values (POWX and ΔX or MINX and MAXX) which are used for the normalizing factors and scale increments; ignored if equal to zero.

INCRY Variable used to specify scales for the dependent axis other than those calculated by the subprogram. A single-integer number composed of two values (POWY and ΔY or MINY and MAXY) which are used for the normalizing factors and scale increments; ignored if equal to zero.

ICHOICE Variable used to draw borders on graph.

If ICHOICE=0 no action is taken.

=2 plot is drawn with a border (upper and right sides), if possible.

N Number of points in scratch arrays; should be equal to or greater than largest data set being plotted. If N is negative the scratch arrays are not restored to their original values.

X Scratch array used for temporary storage of independent array(s) to be plotted.

Y Scratch array used for temporary storage of dependent array(s) to be plotted.

ZAX Variable that determines where the independent axis is drawn.

If ZAX=0. axis is drawn in the standard location. This is also the default position when the next two conditions cannot be met.

=1. axis is drawn at the zero occurrence of the dependent axis.

=2. axis is drawn at standard location with the addition of a zero reference line placed at the zero occurrence on the dependent axis.

ZAY Variable that determines where the dependent axis is drawn.

If ZAY=0. axis is drawn in standard location. This is also the default position when the next conditions cannot be met.

=1. axis is drawn at the zero occurrence of the independent axis.

=2. axis is drawn at standard location with the addition of a zero reference line placed at the zero occurrence on the independent axis.

2.3 Subroutine DRAW2

Subroutine DRAW2 is a printer-plot version[2] of DRAW1. The printer-plot routine mimics DRAW1 and is useful for making test runs or plots for which lower resolution is acceptable. The calling parameters for the printer-plot routine are identical to those for DRAW1 and the routine is accessed by replacing the calls to DRAW1 with calls to DRAW2.

2.4 Subroutine DRAW3

Subroutine DRAW3 is a printer-plot version[2] of DRAW4. The printer-plot routine mimics DRAW4 and is useful for making test runs or plots for which a lower resolution is acceptable. The calling parameters for the printer-plot routine are identical to those for DRAW4 and the routine is accessed by replacing the calls to DRAW4 with calls to DRAW3.

3. DESCRIPTION OF NEW PROGRAMS ADDED TO THE ANAPAC LIBRARY

3.1 Double-Precision Plotting Routines

3.1.1 Subroutines DRAW1D and DRAW2D

Subroutines DRAW1D and DRAW2D are double-precision versions of the plotting subroutines DRAW1 and DRAW2 (sect. 2.1 and 2.3), respectively. The calls to DRAW1D and DRAW2D are identical to calls to the single-precision counterpart except for the independent array, X (the 13th formal parameter), and the dependent array, Y (the 14th formal parameter), which are double precision (REAL*8).

3.1.2 Double-Precison Subroutines for DRAW4 and DRAW3

The first formal parameter (IP) used in subroutines DRAW4 and DRAW3 (sect. 2.2 and 2.4) to select the three sections of the subroutines has been eliminated in the double-precision versions. The other formal parameters are the same. Access to the three sections of these subroutines is accomplished through entry points. The entry points for the double-precision version of DRAW4 and DRAW3 are as follows.

---

[2] *Egon Marx, Printer Version of Plots Made by an Incremental Plotter, Harry Diamond Laboratories TM-75-33 (December 1975).*

SUBROUTINE	DRAW4	DRAW3
Entry point No. 1	DRAW41	DRAW31
Entry point No. 2	DRAW42	DRAW32
Entry point No. 3	DRAW43	DRAW33

The calls to the double-precision DRAW4 are as follows (see sect. 2.2 for definitions of the formal parameters).

```
CALL DRAW41(IFILE,IXLAB,IYLAB,IPTLAB,ISBLAB,XLAB,YLAB,PTLAB,SUBLAB)

CALL DRAW42(IFILE,ITYPE,NPTS,KODE,ISPACE,XVAL,YVAL,YMIN,YMAX)

CALL DRAW43(IFILE,INCRX,INCRY,ICHOICE,N,X,Y,ZAX,ZAY)
```

The formal parameters for calls to the double-precision DRAW3 are the same as for the double-precision DRAW4 subroutine. The values to be plotted, XVAL, and YVAL (the 6th and 7th formal parameters), in calls to DRAW42 and DRAW32 are double precison (REAL*8). The scratch arrays, X and Y (the 6th and 7th formal parameters), in call to DRAW43 and DRAW33 are also double precision (REAL*8). All other formal parameters are the same as in the single-precision subroutines DRAW4 and DRAW3.

3.2 Off-Line Plotting

Subroutine PLOT,[3] which controls the plotter and is stored in ANAPAC, was modified to use the punch file on the IBM system. By means of a simple patch to the IBM 360/20 emulator on the Mohawk 2400 system, the punch file is routed to the plotter.

The punch file can also be received on tape, but the special EBCDIC characters that the plotter expects are lost on a 7-track tape. A second version of the subroutine PLOT was designed to produce a punch file that could be received on 7-track tape without the loss of this information (see sect. 4). This version in addition produces records that identify the job name and the plot number within the job, and numbers each plot record modulo 1000. These new features allow searches of a particular plot and automatic removal of repeated records in case of an interruption of the transmission. This subroutine is stored in a separate library that can be accessed when using a JCL procedure such as ANAFORT.

[3] *Thomas V. Noon, Enhanced Plotting Software for Use with the Houston Instrument Complot Plotter, Harry Diamond Laboratories TM-75-32 (December 1975).*

When off-line plotting is selected, an MDL (Mohawk data language) program is used on the Mohawk terminal to obtain the plots. The job name and plot number appear on the cathode-ray tube (CRT) as each plot on the tape is started, and the plotting stops either when a tape mark (produced by pushing the appropriate sense switch after receiving the plots) is found or when a gap of less than 500 records is found on the file. If sense switch A is set, the program operates in a search mode without plotting, and when the switch A is reset, the program HALTS after finding the beginning of the next plot. A RUN instruction will reinitiate the plotting. If sense switch B is set when the program is started or restarted, the CRT displays a request for the input of the job name (which can be omitted) and the plot number to be searched for on the tape; plotting begins after a match has been found.

3.3 Double-Precision Fourier Transform Routines

3.3.1 Subroutine FFTD

Subroutine FFTD is a double-precision version of FFT which performs a forward or an inverse Fourier transform of an equispaced array of N points, where N=2**NPOW. Subroutine FFTD makes use of the Cooley-Tukey algorithm. The input and output for FFTD is passed by the same formal parameter, A. For the inverse transform, the output is obtained by taking the REAL part of the output array. By convention, the sign of the exponent in the integral is negative for the forward transform and positive for the inverse transform.

Subroutine FFTD is called as follows.

```
CALL FFTD(A,NPOW,N,DX,ISIGN)
```

- A Complex array containing input or output data (COMPLEX*16).
- NPOW Power of 2.
- N Number of points in data array.
- DX Increment for independent array (REAL*8).
- ISIGN Plus or minus 1; value of p desired in transform, $\int g(t)e^{p2\pi ift}dt$.

3.3.2 Subroutine FLATD

Subroutine FLATD is a double-precision version[4] of FLAT which performs a forward Fourier transform of an equispaced array by approximating the given function with a piecewise linear function and then using the Cooley-Tukey algorithm to obtain a sampling of the Fourier transform. The input and output for FLATD are passed by the same formal parameter, A.

Subroutine FLATD is called as follows.

CALL FLATD(A,N,DX,ISIGN)

- A Complex array containing input and output data (COMPLEX*16)
- N Number of points in data array; a power of 2.
- DX Increment of independent array (REAL*8).
- ISIGN Plus or minus 1; value of p desired in transform $\int g(t)e^{p2\pi ift}dt$.

3.3.3 Subroutine FLITD

Subroutine FLITD is a double-precision version[4] of FLIT which performs an inverse Fourier transform of an equispaced array. The input and output for FLITD are passed by the same formal parameter, A. The input data are placed in the first N/2+1 points. The output is obtained by taking the REAL part of the whole output array.

Subroutine FLITD is called as follows.

CALL FLITD(A,N,DX,ISIGN)

- A Complex array containing data (COMPLEX*16).
- N Number of points in data array; a power of 2.
- DX Increment for independent array (REAL*8).
- ISIGN Plus or minus 1; value of p desired in transform, $\int g(f)e^{p2\pi ift}dt$.

---

[4] *Alfred Brandstein and Egon Marx, Numerical Fourier Transform, Harry Diamond Laboratories TR-1748 (December 1975).*

3.4 Subroutines CLINTD and LINTD

Subroutines CLINTD and LINTD are double-precision versions of CLINT and LINT which perform a linear interpolation between the points in the given array. The outputs from CLINTD and LINTD are equispaced arrays. The output array for CLINTD is complex; that for LINTD is real. Any points which fall outside the range of the input variable are given a value of zero in the output array.

Subroutines CLINTD and LINTD are called as follows.

```
CALL CLINTD(X,Y,N,M,DX,YOUT)
```

or

```
CALL LINTD(X,Y,N,M,DX,YOUT)
```

X Independent array, time (REAL*8).

Y Dependent array, amplitude (REAL*8).

N Number of points in X and Y arrays.

M Number of points in YOUT array.

DX Increment for independent variable (REAL*8).

YOUT Dependent output array (REAL*8); complex for CLINTD (COMPLEX*16).

4. CATALOGUED PROCEDURE ANAFORT

The catalogued procedure ANAFORT can be used to compile, link-edit, and execute a FORTRAN program that uses subroutines found in the ANAPAC library. Two other libraries can be concatenated with FORTLIB--PAGLOAD and ANAPAC--through the symbolic parameters PRELIB and POSTLIB. Furthermore, substitution of the OFFPLOT parameter with the library where the version of PLOT that allows for off-line plotting is stored produces a punch file that can be received on 7-track tape (but cannot produce plots on line).

If DRAW3 or DRAW4 are used, disc files for FT01F001 through FT04F001 can be defined on VIO simply by nullifying the symbolic parameters F1 through F4. If disc files FT08F001 through FT13F001 are required, the corresponding DD statements have to be included in the deck. For example:

```
//FT09F001  DD  UNIT=VIO,DISP=(,PASS),SPACE=(CYL,(1,1))
```

The outputs produced by the compiler and link-editor can be eliminated by setting the symbolic parameter OUT equal to X.

5. ACCESSING PROGRAMS FORMERLY STORED IN THE TRANL USER'S LIBRARY

5.1 Catalogued Procedure GRAFC

This procedure is used to execute the program GRAFC. Program GRAFC provides the means to convert the punched-card digitized data into the control commands and data points recorded by the Science Accessories Corporation (SAC) digitizer for the purpose of error correction and modification of the digitized data. The program is executed as follows.

```
//         EXEC GRAFC
//SYSIN  DD   *
    digitized data
  (7/8/9 card)
//
```

5.2 Catalogued Procedure TRANS

The procedure is used to execute the program TRANS which translates the punched-card output from the SAC digitized system into the coordinates of the original data. If the data file written by the TRANS is to be catalogued for future use, the substitutable parameters NAME and DISP='(NEW,CATLG)' are required. Otherwise a temporary file name of TEMP and a DISP of (NEW,PASS) are used and the file is passed for subsequent use by other steps in the job.

For the IBM version of TRANS the digitized data set(s) must be preceded by a NAMELIST card titled OUTPUT. The namelist data consists of two logical variables, LIST and PLOT. LIST controls the printing of the data sets being processed and PLOT controls the plotting of the data sets. The default value is FALSE for both variables. A value of TRUE for either LIST or PLOT turns on either the printing or plotting of the data sets, respectively. The program is executed as follows.

```
//        EXEC TRANS
//SYSIN DD    *
 &OUTPUT                            &END
   digitized data
 (7/8/9 card)
//
```

5.3 Catalogued Procedure TEDD

This procedure is used to execute the program TEDD which provides the ability to plot selected time windows of a digitized data set or any other discrete data set in order to expand portions of a trace for clarity or to display the individual data points. The input file name is supplied to TEDD using the substitutable parameter NAME. The default file name is TEMP, the same as in TRANS, and the default DISP is (OLD,PASS). The program is executed as follows.

```
//        EXEC TEDD,NAME='FILENAME'
//SYSIN   DD   *
    time window data
//
```

Program TEDD can process multiple data sets within a maximum of six time windows per data set (the time windows can overlap). The maximum and minimum for the dependent variable can also be specified to maintain the same perspective for the plots. The format for the maximum and minimum values and the time windows is "6X,2E10.3" with one time window per card. Each group of time windows must be separated by an EOI card (7/8/9 punch).

The input data for TEDD are as follows.

Card 1	AMIN	Minimum value of scale for plotting of dependent array; ignored if equal to zero.
	AMAX	Maximum value of scale for plotting of dependent array; ignored if equal to zero.
		Format (6X,2E10.3)
Card 2	T1	Lower limit of first time window to be expanded.
	T2	Upper limit of first time window to be expanded.
		Format (6X,2E10.3)
Card 3	T1&T2	Limits for second time window; same as card 2.
.		
.		
.		
Card 7	T1&T2	Limits for sixth time window; same as card 2.

Program TEDD can also be applied to other types of data files compatible with RDTAPE from the ANAPAC library.

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